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PATENT ABSTRACTS OF JAPAN

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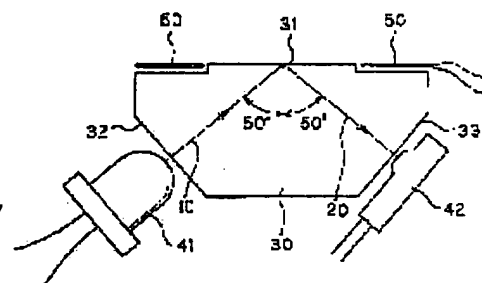
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(54) OIL QUANTITY MEASURING DEVICE FOR SKIN

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device capable of automatically measuring the quantity of oil on the skin surface without consumables such as a roughening seal or the like.

SOLUTION: In this device for measuring the quantity of oil on the skin in contact with the skin surface of a subject, the oil quantity measuring device includes a transparent body 30 having an index of refraction n_g larger than the index of refraction n_{oi} and having a contact surface 31 coming into contact with the skin surface of the subject, wherein a light source 41 is disposed to radiate illuminating light 10 at an angle of incidence larger than the critical angle θ_{Cwo} of the transparent body to moisture and smaller than the critical angle θ_{Coi} of the transparent body to the oil on the skin surface, and a photo detector 42 is disposed to detect the reflected light 20 internally reflected on the contact surface 31.



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CLAIMS

[Claim(s)]

[Claim 1] It sets to the equipment which is contacted on the skin front face of an analyte and measures the oil quantity of the skin, and is a refractive index n_g . The transparent body equipped with the contact surface which it is the larger transparent body than the refractive index n_{oi} of the oil content on the front face of the skin, and is contacted on the skin front face of an analyte is included. Critical angle θ_{Cwo} [as opposed to the moisture from the aforementioned transparent body side to the aforementioned contact surface] of the aforementioned transparent body Critical angle θ_{Coi} [as opposed to / are a big incident angle and / the oil content on the front face of the skin] of the aforementioned transparent body The light source is arranged so that lighting light may be irradiated with a small incident angle. And the oil quantity measuring device of the skin characterized by arranging the light sensitive cell so that the reflected light by which internal reflection was carried out by the aforementioned contact surface may be detected.

[Claim 2] The oil quantity measuring device of the skin according to claim 1 characterized by the aforementioned transparent body being equipped with the plane of incidence and the injection side other than the aforementioned contact surface, and facing the aforementioned plane of incidence, and arranging the aforementioned light source, facing the aforementioned injection side, and arranging the aforementioned light sensitive cell.

[Claim 3] The oil quantity measuring device of the skin according to claim 1 or 2 to which the aforementioned light source is characterized by the bird clapper from Light Emitting Diode.

[Claim 4] The oil quantity measuring device of the skin of three given in any 1 term from the claim 1 characterized by arranging the capacitor of the capacitor type moisture-content measuring device of the skin around the aforementioned contact surface of the aforementioned transparent body at one.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention relates to the equipment which can measure the oil quantity on the front face of the skin automatically easily without an article of consumption about the oil quantity measuring device of the skin.

[0002]

[Description of the Prior Art] It is important, when choosing cosmetics to measure people's moisture content and oil quantity on the front face of the skin. If a man with many moisture contents uses oily cosmetics or a man with many oil quantities uses water cosmetics, the skin will be damaged or the paste of cosmetics will become bad.

[0003] Then, for measurement of the moisture content of the skin, the moisture content is conventionally measured by pressing against the skin the field type capacitor which has protected the front face using the dielectric constant of water being high, and measuring capacity change of the capacitor.

[0004] On the other hand, split-face-ize a front face for measurement of the oil quantity of the skin, using a seal, force the split-face side of the seal on the skin, and infiltrate an oil content according to capillarity in the crevice of a split face. The oil quantity is measured by applying light to the seal from a rear-face side, and measuring the intensity of the scattered light using a split face smoothing and dispersion of light decreasing, so that there are many oil contents adhering to the seal.

[0005]

[Problem(s) to be Solved by the Invention] However, by the method using this split-face-ized seal, since the oil content which sank into the split face is easily unremovable, the seal was exchanged for the new thing for every measurement, and the used seal has been discarded. Therefore, measurement cost will become expensive while it is severe by environment. Furthermore, the oil quantity and moisture content on the front face of the skin cannot be measured simultaneously in the same part.

[0006] this invention is made in view of such a trouble of the conventional technology, and the purpose is offering the equipment which can measure the oil quantity on the front face of the skin automatically easily, without using an article of consumption like a split-face-ized seal.

[0007]

[Means for Solving the Problem] The oil quantity measuring device of the skin of this invention which attains the above-mentioned purpose It sets to the equipment which is contacted on the skin front face of an analyte and measures the oil quantity of the skin,

and is a refractive index n_g . The transparent body equipped with the contact surface which it is the larger transparent body than the refractive index n_{oi} of the oil content on the front face of the skin, and is contacted on the skin front face of an analyte is included. Critical angle θ_{Cwo} [as opposed to the moisture from the aforementioned transparent-body side to the aforementioned contact surface] of the aforementioned transparent body Critical angle θ_{Coi} [as opposed to / are a big incident angle and / the oil content on the front face of the skin] of the aforementioned transparent body The light source is arranged so that lighting light may be irradiated with a small incident angle. And it is characterized by arranging the light sensitive cell so that the reflected light by which internal reflection was carried out by the aforementioned contact surface may be detected.

[0008] In this case, it is desirable for the transparent body to be equipped with the plane of incidence and the injection side other than the contact surface, and to face plane of incidence, and to arrange the light source, to face a injection side, and to arrange the light sensitive cell.

[0009] Moreover, it is desirable to use Light Emitting Diode as the light source.

[0010] Moreover, the capacitor of the capacitor type moisture-content measuring device of the skin shall be arranged around the contact surface of the transparent body at one.

[0011] It sets to this invention and is a refractive index n_g . The transparent body equipped with the contact surface which it is the larger transparent body than the refractive index n_{oi} of the oil content on the front face of the skin, and is contacted on the skin front face of an analyte is included. Critical angle θ_{Cwo} [as opposed to the moisture from the aforementioned transparent-body side to the aforementioned contact surface] of the aforementioned transparent body Critical angle θ_{Coi} [as opposed to / are a big incident angle and / the oil content on the front face of the skin] of the aforementioned transparent body The light source is arranged so that lighting light may be irradiated with a small incident angle. And since the light sensitive cell is arranged so that the reflected light by which internal reflection was carried out by the aforementioned contact surface may be detected, it can measure by the low cost, without being able to measure the rate of the oil content of the skin of an analyte automatically easily, without being influenced of moisture, and using an article of consumption like a split-face-ized seal.

[0012]

[Embodiments of the Invention] Hereafter, the principle and example of an oil quantity measuring device of this invention are explained. [of the skin]

[0013] The basic principle of this invention sticks the flat surface of the transparent body like glass to the skin, does not cause total reflection but measures an oil quantity

at a part for oil Wakebe in contact with the flat surface by measuring the intensity of the flux of light which irradiated the flux of light from the transparent inside of the body at an angle which causes total reflection at the flat surface, and was reflected at the flat surface in the moisture portion and air portion in contact with the flat surface.

[0014] Hereafter, it explains more concretely. When based on the principle of an optical refraction, as shown in drawing 4 (a), it is the refractive index of n_1 and an opposite side about the refractive index by the side of the incidence of a plane interface n_2 if it carries out and angle of refraction which measured the incident angle measured from the normal of the interface of an incident light 1 from the normal of the interface of θ and the refraction light 2 is set to β $n_1 \sin \theta = n_2 \sin \beta$... (1)

***** is satisfied. Here, it is $n_1 > n_2$. When filling a relation, θ which becomes $\beta = 90$ degrees exists. θ at that time is critical angle θ_c . It is called. $\sin \theta_c = n_2 / n_1$... (2)

***** is satisfied. This critical angle θ_c if incidence of the incident light 1 is carried out to an interface with the above incident angle θ , as shown in drawing 4 (b), an incident light 1 will fill the law of reflection with the interface, and will be reflected as the reflected light 3 100 (with the same angle of reflection θ as an incident angle θ)%. This phenomenon is called total reflection.

[0015] By the way, as shown in drawing 3 (a), when an inferior surface of tongue pushes plane glass G against the skin front face S, as shown in drawing 3 (b), an oil content 11, moisture 12, and air 13 dissociate and contact the inferior surface of tongue of Glass G. Thus, each dissociates and contacts for not uniting an oil content 11 and moisture 12. Since it is thought that the oil quantity on the front face S of the skin is proportional to the touch area of the oil content 11 which dissociated in this way and contacted, the oil quantity on the front face of the skin can be measured by measuring the area of the oil content 11 within the field of drawing 3 (b).

[0016] the case where the wavelength of use light is 632nm in order to measure the touch area of the oil content 11 of drawing 3 (b) — the refractive index ($n_{wo}=1.33$) of moisture, and the refractive index ($n_{ai}=1$) of air — the refractive index ($n_{oi}=1.58$) of an oil content — large — refractive index n_g of Glass G a bigger thing than the refractive index n_{oi} of an oil content — choosing — namely, — $n_g > n_{oi}$... (3)

critical angle θ_{cwo} [as opposed to / when carrying out / the moisture portion 12] of Glass G And critical angle θ_{cai} of Glass G to the air portion 13 an oil content — critical angle θ_{coi} of Glass G to a portion 11 it is shown in drawing 1 using a small thing — as — θ_{coi} small — θ_{cwo} the big incident angle θ — namely, — $\theta_{cwo} < \theta < \theta_{coi}$... (4)

What is necessary is to make the undersurface of Glass G carry out incidence of the incoming beams 10 from Glass G side with the incident angle θ which carries out ** satisfactory, to make total reflection cause in the moisture portion 12 and the air portion 13, and just to measure the intensity of the reflected light 20 reflected on the undersurface of Glass G as total reflection does not occur in a part for oil Wakebe 11. When the rate in the inside of the incoming beams 10 of the touch area of an oil content 11 is set to K, the intensity P of the reflected light 20 shows a relation as shown in drawing 2. For at least 100%, not being set to 0 is [the rate of an oil content / the intensity P of the reflected light 20] the refractive index n_g of Glass G. It is because there is the reflected light by the Fresnel reflection in the interface by the difference of the refractive index n_{oi} of an oil content. In addition, it is more more desirable to use P polarization as incoming beams 10, in order to weaken intensity of this Fresnel reflection.

[0017] Hereafter, an example is explained. Since it is refractive-index $n_{wo}=1.33$ of moisture and is refractive-index $n_{oi}=1.58$ of an oil content as described above, when using the thing of $n_g=1.84$, it becomes critical angle $\theta_{Cwo}=46.3$ degree of the glass G to the moisture portion 12, and critical angle $\theta_{Coi}=59.2$ degree of the glass G to a part for oil Wakebe 11 as a refractive index of Glass G. Therefore, the oil quantity measuring device of the skin of this invention can be constituted by choosing the configuration of Glass G so that it may become the interface incident angle of $\theta=50$ degrees of the incoming beams 10 in Glass G.

[0018] Drawing 5 is the cross section of the principal part of one example of the oil quantity measuring device of the skin of this invention constituted based on the above, a glass block 30 is arranged and the refractive index is chosen as $n_g=1.84$. The osculating plane 31 contacted by the skin of an analyte, the incidence flat surface 32 which carries out incidence, without refracting the incoming beams 10 which carry out incidence to this flat surface 31 with the incident angle of $\theta=50$ degrees from the inside of a block in a glass block 30, and the injection flat surface 33 made to inject without being refracted out of a block of the reflected light 20 which carried out total reflection at the flat surface 31 are formed in the glass block 30. And the incidence flat surface 32 is approached, Light Emitting Diode 41 is arranged, the injection flat surface 33 is approached, and the photodiode 42 is arranged.

[0019] Here, Light Emitting Diode 41 is $\theta_{Cwo}=46.3$ degrees $< \theta < 59.2$ -degree= θ_{Coi} in an osculating plane 31, even if it does not prepare the lens for collimators between Light Emitting Diode 41 and the incidence flat surface 32, since the homogeneous light is emitted by the less than 10-degree angle of divergence. A relation ((4) formulas) can be filled and incidence of the incoming beams 10 can be carried out.

However, it is more desirable that a collimator lens is arranged between Light Emitting Diode 41 and the incidence flat surface 32, and it is made to make incoming beams 10 into parallel light.

[0020] Since it is such arrangement, the osculating plane 31 of a glass block 30 is forced on the skin of an analyte, Light Emitting Diode 41 is turned on, incoming beams 10 are irradiated at an osculating plane 31, and the oil content of the skin of an analyte can ask for K comparatively by detecting the intensity of the reflected light 20 by the photodiode 42, without being influenced of moisture.

[0021] In addition, in the example of drawing 5, the field type capacitor 50 of the conventional moisture-content measuring device is arranged around the osculating plane 31 of a glass block 30 at one, and if a glass block 30 is forced on the skin of an analyte, this field type capacitor 50 also has composition forced simultaneously. Therefore, the rate of the moisture of the skin of an analyte is also simultaneously detected by detecting by the capacitor capacity detector which does not illustrate the capacity of this field type capacitor 50.

[0022] As mentioned above, although the oil quantity measuring device of the skin of this invention has been explained based on the principle and example, this invention is not limited to these examples, but various deformation is possible for it. For example, you may use LD instead of Light Emitting Diode as the light source.

[0023]

[Effect of the Invention] According to the oil quantity measuring device of the skin of this invention, so that clearly from the above explanation Refractive index n_g The transparent body equipped with the contact surface which it is the larger transparent body than the refractive index n_{oi} of the oil content on the front face of the skin, and is contacted on the skin front face of an analyte is included. Critical angle θ_{cwo} [as opposed to the moisture from the aforementioned transparent-body side to the aforementioned contact surface] of the aforementioned transparent body Critical angle θ_{coi} [as opposed to / are a big incident angle and / the oil content on the front face of the skin] of the aforementioned transparent body The light source is arranged so that lighting light may be irradiated with a small incident angle. And since the light sensitive cell is arranged so that the reflected light by which internal reflection was carried out by the aforementioned contact surface may be detected, it can measure by the low cost, without being able to measure the rate of the oil content of the skin of an analyte automatically easily, without being influenced of moisture, and using an article of consumption like a split-face-ized seal.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing for explaining the measurement principle of the oil quantity measuring device of the skin of this invention.

[Drawing 2] It is drawing showing the relation between the rate of an oil content, and the intensity of the reflected light in arrangement of drawing 1.

[Drawing 3] It is drawing showing signs that an oil content, moisture, and air dissociate and contact in the situation and case at the time of pushing glass against a skin front face.

[Drawing 4] It is drawing for explaining the principle and total reflection of an optical refraction.

[Drawing 5] It is the cross section of the principal part of one example of the oil quantity measuring device of the skin of this invention.

[Description of Notations]

G -- Glass

S -- Skin front face

1 -- Incident light

2 -- Refracted light

3 -- Total reflection light

10 -- Incoming beams

11 -- Oil content (portion)

12 -- Moisture (portion)

13 -- Air (portion)

20 -- Reflected light

30 -- Glass block

31 -- Osculating plane

32 -- Incidence flat surface

33 -- Injection flat surface

41 -- Light Emitting Diode

42 -- Photodiode

50 -- Field type capacitor